CONTRIBUTIONS FROM THE ZOÖLOGICAL LABORATORY OF THE MUSEUM OF COMPARATIVE ZOÖLOGY AT HARVARD COLLEGE. E. L. MARK, DIRECTOR. No. 173

DOUBLE HENS' EGGS

G. H. PARKER

THE presence of an additional yolk or of a second more or less perfect egg in a hen's egg, though not an unusual occurrence, is rare enough to excite the attention of those interested in natural phenomena and has been a matter of record since the time of Aristotle. A recapitulation of the early instances of this kind has already been given by Davaine ('61), who has also added much to our knowledge of double eggs. The following account contains a description of five such eggs which have come to the writer's notice in the past few years and present certain features worthy of record.

Of these eggs the first to be described was laid 26 June, 1905, by a hen belonging to Mrs. Prince Stuart of Wood's Hole, Mass. I am indebted to Mr. A. S. Pearse for the opportunity of examining it. The egg was unusually large, its major axis measuring 74 mm., its minor 55 mm. In form it was not unlike a normal egg except that the point was less certainly distinguishable from the butt than is commonly the case. The shell was almost white; near the poles its surface was smooth, but about its equator there was a broad band of unusual roughness. Within was a normal shell membrane inclosing a single mass of albumen containing two yolks. These lay one toward the butt, the other toward the point of the egg. The one toward the butt was approximately spheroidal with its major axis at right angles to that of the whole egg. It measured 34 mm. by 30 mm. The yolk nearer the point was smaller than the other one, by which it was indented on the side away from the point. It measured 21 mm. by 27 mm., and its major axis was also at right angles to that of the whole egg.

Though the two yolks were in intimate contact along their applied faces, they were organically distinct, since each possessed an independent vitelline membrane. So far as could be judged, they were of the same age, in that both had the appearance of freshly laid yolks.

The second egg to be described is one that I had the privilege of examining through the kindness of Mr. C. C. Spratt. It had been laid in the spring several years ago by a hen belonging to Mrs. C. H. Gould of North Bridgton, Me. The outer shell, which was thick but otherwise normal, was much broken; its two axes measured 54 mm. and approximately 73 mm. It was lined with a shell membrane and its contents were lost except for a small complete egg which it contained. This measured 33 mm. by 39 mm., and, though rather roundish in outline, it presented a butt and a point. Its shell was thinner than usual and its whole outer surface was granular. The inside of this shell was lined with a shell membrane and contained dried albumen and a dried yolk.

The three remaining eggs were laid by a hen belonging to Mr. F. Nielson of Medford, Mass. They were laid in March, 1903, and shortly after the laying of the largest one the hen died. When the eggs came to my hands, each had a small opening at one end. I am therefore unable to give their exact length but in other respects they were in excellent condition for examination. The smallest measured 43 mm. by approximately 57 mm., the next 48 mm. by approximately 56 mm., and the largest and last to be laid 55 mm. by approximately 71 mm. In each instance a point and a butt could be distinguished and the shells were of normal texture, color, and thickness. Each shell contained a shell membrane and a mass of albumen in which was imbedded a second smaller egg.

These eggs were used for exhibition purposes, but I was allowed to cut open the one of intermediate size, and the appearance of its section face is given in the accompanying figure. It will be seen at once that the inclosed egg is relatively large; it measured 45 mm. by 29 mm. A butt and a point could be easily distinguished on it. The chief axis of the small egg was parallel to that of the large one and its point and butt were just within the corresponding

parts of the inclosing shell. The shell of the small egg was rather thin; it was lined with a shell membrane and contained albumen which had withdrawn slightly from the shell wall, probably through shrinkage. Between the inner shell and the membrane lining the outer shell, was a mass of albumen, which was slightly discolored around the equator of the smaller egg and near its butt by a small amount of yolk substance. Aside from this neither the larger nor the smaller egg contained any evidence of yolk.

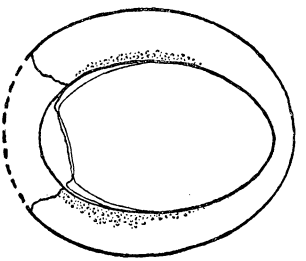

FIG. 1.—A double egg cut in longitudinal section from butt to point. The outer shell measured 48 mm. by about 56 mm.; the inner, 29 mm. by 45 mm.; both contained albumen, that of the inclosing egg showing yolk substance (drawn as granules in the figure). Beginning at the butt of the egg, the dotted line represents the reconstructed shell; the first solid line, the shell of the inclosed egg; the second, its shell membrane; and the third, the surface of its albumen. The spaces between shell and membrane, and membrane and albumen, are probably due to shrinkage.

The internal condition of the other two eggs belonging to this set could not be ascertained, for the owner preferred to keep them in their present form. Judging, however, from what could be seen through the small holes in their ends, they contained relatively large eggs with firm limy shells like that seen in the egg that was cut.

An examination of the five eggs thus far described and a comparison of their conditions with those of other recorded cases of double eggs, have led me to the conclusion that at least two factors are concerned in the production of such eggs. Double-yolk eggs like the first one described, are due in my opinion to the simultaneous or almost simultaneous discharge of *two* yolks from the ovary instead of *one*, these two being enveloped by albumen, shell membrane, and shell in an essentially normal manner. Inclosed eggs on the other hand may be the product of an entirely normal ovary and may result from the abnormal action of the oviduct, in that a yolk normally supplied by the ovary may be abnormally covered, retained, and inclosed in another egg. Thus two factors in the production of double eggs may be distinguished: ovarian and oviducal.

That these two factors are really independent is indicated in several ways. First, they seem to come into play at somewhat

different seasons. The double-yolk egg described in this paper was laid in June, and, though Bauer ('98, p. 304) and Immermann ('99, p. 7) record cases of this kind in December and Panum ('60, p. 186) in January, the great majority of such occur during the warmer part of the year, from May to August according to Immermann ('99, p. 7) or from March to September according to Panum ('60, p. 186). The inclosed eggs on the contrary are produced in the winter and spring. Thus the second egg described in this paper was laid at some time in the spring and the remaining three in March. A compilation of the published records of this kind shows the period to extend from December to March or April.[1] It therefore appears that while double-yolk eggs may be laid at any time of year, they are most abundant in summer and that inclosed eggs, so far as the records go, are limited exclusively to the winter and spring.

Another point in evidence of the independence of the ovarian and oviducal factors is seen in the condition of the hen. The laying of eggs with two yolks may become, as Landois ('78, p. 24) declares, almost habitual with certain hens. Bartels ('95, p. 143) states that the hen that laid the double egg described by him had often laid such eggs and Immermann ('99, p. 8) records the case of a hen that laid such an egg about every eight days. Apparently this is as much an organic peculiarity of certain hens as is the production of twins by certain individuals in the human species, and, while it may be called abnormal in that it is unusual, it is in no sense indicative of serious organic derangement or disease. The laying of inclosed eggs, however, is often followed by serious consequences to the hen. Thus the hen belonging to Mr. Nielson died shortly after laying the last of the lot of three inclosed eggs described in this paper, and the same fate immediately overtook the hen that laid the two inclosed eggs described by Fritsch ('95). Evidently the laying of such eggs indicates a more serious state of affairs so far as the hen is concerned than the laying of double-yolk eggs and brings out again a difference between the ovarian and the oviducal factors.

[1] Inclosed eggs have been recorded as laid in winter (Chobaut, '97), December (Philippi, '93), January (Parona e Grassi, '77), March (Collin, '94; Féré, :02), and at Easter (Schumacher, '96).

As a result of the action of these two factors, three classes of double eggs can be distinguished: first, those whose yolks have come from an abnormal ovary but have passed through a normal oviduct; secondly, those whose yolks have come from a normal ovary but have passed through an abnormal oviduct; and finally, those produced by an ovary and oviduct both of which have been abnormal in their action.

Of the first class little need be said. Although eggs with three yolks are extremely rare, those with two are of rather common occurrence and, as has been pointed out, they are often repeatedly laid by a given hen without injury to herself. As Immermann ('99, p. 10) rightly observed, these eggs fall into two subclasses: the first includes eggs in which the yolks have separate vitelline membranes, and the second those in which the two yolks are within one membrane. In the former the yolks were probably discharged simultaneously from separate ovarian follicles; in the latter both yolks very likely came from the same follicle. When these eggs are incubated, the two embryos begin their development together and proceed at about the same rate. In this respect they are in strong contrast with most inclosed eggs in which, as in the egg described by Féré (:02, p. 349), the inclosed yolk is in advance of the inclosing one in development. The two yolks of double-yolk eggs are usually each of normal size and in consequence induce the formation of a large egg, though the volume of the whole is usually not more than once and a half to once and three quarters that of a normal egg. The fact that hens can lay such large eggs repeatedly and yet without injury to themselves, shows that the death of the hen, which often follows the laying of inclosed eggs, cannot be attributed merely to mechanical causes.

Under this first class of abnormalities have also been placed eggs with yolks of unusual form, such as the apparently double-yolk egg described by Möbius ('95). Since such apparently double or partly double yolks often arise from a rupture of the vitelline membrane and a flowing out of yolk substance, they cannot of course be regarded as real examples of double yolks. Such yolk hernias may be due either to a weak vitelline membrane or, as Davaine ('61, p. 256) has suggested, to a constricted oviduct, but in either case they are not to be classed with true double eggs.

The second class of abnormal eggs includes those in which a normal yolk is received by an abnormal oviduct and in consequence becomes covered with an abnormal set of envelopes. This is represented by eggs that are normal as to contents, form, and size, but are contained in other larger eggs. Instances of this kind have been described by Barnes ('63; '85), Fritsch ('95), Chobaut ('97), and Gruvel (:01). Very likely the second egg described by Supino ('97) belongs to this class, but the inclosed egg, though of normal size, is said to contain an unusual yolk, indicating possibly an ovarian abnormality. Here also should probably be placed an egg recorded by Féré (:02) in which the inclosed yolk, though apparently normal, is contained in a small amount of albumen and what appears to be a thick egg membrane, but is without a shell.

In most of the instances just cited, the enveloping eggs are of two kinds. The first consists of shell, membrane, and albumen as in the cases described by Fritsch, Chobaut, and Gruvel; and the second possesses a yolk in addition to these parts, as in the eggs recorded by Barnes and Supino. The exact method by which a normal egg becomes inclosed in a second more or less complete egg is not wholly clear; but a discussion of this question will be deferred till the third class of eggs has been described.

In the third class of double eggs there is evidence of both ovarian and oviducal abnormalities. In examples of this kind the inclosed eggs usually consist of shell and membrane containing a mass of albumen and a small yolk, as in the cases recorded by Vaillant ('75), Parona e Grassi ('77), de Man ('78), Philippi ('93), Schumacher ('96), Herrick ('99a; '99b, p. 409), and Kunstler et Brascassat (:01); or inclosing albumen but without a yolk, as in the first egg described by Supino ('97), and those described by Herrick ('99b, p. 410), and Gruvel (:02). In this class two types of inclosing eggs might be expected: one with a yolk and one without a yolk, but, strange to say, of the nine instances[1] in which the descriptions are sufficiently full to allow this point to be ascertained, the inclosing egg always consisted of shell, albumen, and yolk.

[1]Parona e Grassi ('77), de Man ('78), Philippi ('93), Schumacher ('96), Supino, two eggs ('97), Herrick, two eggs ('99a; '99b), and Kunstler et Brascassat (:02).

Notwithstanding the fragmentary character of the second egg described in this paper, it undoubtedly falls under the third class; and I am also of the opinion that the three eggs from Mr. Nielson's hen likewise belong here. It will be remembered, however, that of these three eggs the one that was opened presented the remarkable feature, not hitherto recorded to my knowledge, of the absence of yolks from both the inclosed and the inclosing egg, though traces of yolk substance were found in the latter. These traces lead me to believe that the inclosing egg originally contained a yolk which, however, probably broke and almost entirely ran out before the membrane and shell of this egg were formed.

To explain how such inclosed eggs reach their positions, at least two hypotheses have been put forward. According to the first of these, which has been advocated by Davaine ('61, p. 238), Schumacher ('96, p. 368), Herrick ('99b, p. 413), and Kunstler et Brascassat (:01; :02), an egg after having passed by peristalsis to the distal end of the oviduct and after having received its usual coverings of albumen, shell membrane, and shell, is supposed to be carried by antiperistalsis up the oviduct where it meets a second egg, and passing down with this, becomes covered by a second shell, and is laid.

According to the second hypothesis, which has been advanced by Panum ('60, p. 185), Chobaut ('97), and Rabaud (:02), antiperistalsis plays no part in the formation of inclosed eggs, but the egg which is to be inclosed remains in the distal part of the oviduct instead of being laid and is there overtaken by a second egg while the second one is still without shell. After the second egg has enveloped the first, a shell inclosing both is laid down.

In testing these two hypotheses, the chief question is whether or not there is any evidence for antiperistalsis. The common occurrence of a small egg with a limy shell in the albumen of a large one whose shell membrane is intact, seems to me inexplicable except on the assumption of antiperistalsis. Such an egg as the smaller one could not receive its shell except by resting some time in the distal part of the oviduct and it could not come to lie in the albumen of another egg whose shell membrane was not ruptured except by passing to a region in the oviduct above that in which the shell membrane is formed; as this region is proximal to the

shell-forming portion of the duct the operation seems to me to necessitate antiperistalsis. It might be assumed that the inclosed egg made its way into the albumen of the inclosing one by rupturing the shell membrane of the latter just as that egg reached the shell chamber of the oviduct. But there is no evidence in such eggs of a ruptured membrane as this hypothesis would require and indeed there is a case on record (Gruvel, :02, p. 73) in which the inclosed egg apparently met the inclosing one when the shell membranes of the latter were forming and, instead of rupturing them, the inclosed egg remained between the inner and outer membrane and never entered the albumen of the inclosing egg at all. I therefore do not believe that the inclosed egg enters the albumen by rupturing egg membranes but by meeting the inclosing egg by antiperistalsis high in the oviduct and before the membranes have been formed.

Another fact that seems to me impossible of explanation except on the assumption of antiperistalsis is the occurrence of "soft-shelled" eggs in the body-cavities of fowls. This has been recorded by Davaine ('61, p. 241) and more recently by Landois ('99, p. 52), who states that in one instance he found four such eggs in the body-cavity of a hen. Two of these were broken, but two were whole and had all the appearances of normal eggs except that they lacked shells. As there is no source for the albumen and shell membranes of these eggs except the middle and lower part of the oviduct and no way into the body-cavity except by the infundibulum, I believe the conclusion inevitable that these eggs, after the formation of their shell membranes, were moved proximally by antiperistalsis.

How antiperistalsis is excited in the oviducts is not understood. It has been suggested that an egg of small volume might induce such a movement and thus be returned to the upper part of the oviduct, but, though this cannot be denied, it must be remembered that, as Landois ('95, p. 32) has shown, small eggs such as are often found in large ones, may be laid by hens. Moreover, as was stated in describing inclosed eggs of the second class, eggs of normal size are often found within the shell membranes of excessively large eggs and must therefore have moved up the oviduct. Hence the small size of an egg cannot be the only cause of antiperistalsis, if in fact it is at all effective in this respect.

Although in the present state of our knowledge it is impossible to assign a cause for the setting-in of antiperistalsis, it seems to be a process that may occur not only once but even twice in the enveloping of a yolk. Davaine ('61, p. 237) quotes a case in which an egg presented the very unusual condition of three separate envelopes instead of two; these were a firm outer shell, a strong shell membrane, and a thin shell membrane, and a second case is given by Landois ('92, p. 34) of an egg of the red-backed shrike (*Lanius collurio* L.) that had three shells one within the other.

So far as I know, the only objection that has been raised against antiperistalsis of the oviduct has come from Rabaud (:02, p. 201), who claims that this process could not bring two eggs *together*, but would simply move them up or down the oviduct. But such an objection is formal rather than otherwise, for it must be evident to anyone who has watched the process as it occurs in the intestines that its local character is such that eggs could easily be made to approach in the oviduct through its means. I therefore dismiss this objection as without weight.

Although I believe antiperistalsis to be an all important factor in the formation of inclosed eggs, it is in all probability sometimes greatly restricted, as is indicated by an egg described by De Toni ('90) and the second of the two described by Supino ('97). In both these eggs the outer surface of the inclosed shell is adherent to the inner surface of the inclosing one; in other words, the albuminous investment of the inclosed egg is imperfect, as though the smaller egg, while resting in the shell chamber of the oviduct, was imperfectly enveloped by the inclosing egg, whose shell on forming adhered to the inner shell where the envelope was incomplete. Thus an inclosed egg might be imagined to arise after the manner suggested by the second hypothesis already given. But in both these instances the inclosed egg lies in the albumen of the inclosing one and within its shell membrane, and, as already pointed out, it is impossible to explain this position except on the assumption of at least some slight antiperistalsis. I therefore believe that the formation of inclosed eggs cannot take place simply by the undue retention of one egg till it is overtaken by another, as stated in the second hypothesis, but that in all instances some antiperistalsis occurs.

Admitting antiperistalsis to be essential to the formation of inclosed eggs, it is interesting to observe that, notwithstanding the migrations of these eggs, they appear to retain always the same axial relations to the oviduct that they had in the beginning. This is clearly seen in the eggs described by Barnes ('63), Chobaut ('97), Herrick ('99b, p. 410), Kunstler et Brascassat (:02), and Gruvel (:02), as well as in one of those described in this paper, in all of which the point of the inclosed egg is in the direction of that of the inclosing one and not toward its butt, showing that the smaller egg has retained its original axial relations to the oviduct even though it has moved in both directions through that tube. Moreover, when the inclosed egg is so small that it might lie either near the point or near the butt of the inclosing egg, it does as a matter of fact (Barnes, '63; Herrick, '99b, p. 410; Gruvel, :02; and Kunstler et Brascassat, :02) always lie near the point, showing, since the egg moves through the oviduct point forward, that it is the second egg that incloses the first and not the reverse.

In one respect the egg obtained from Mr. Nielson is of special interest. As I have already stated, it contained no yolk in either the inclosed or the inclosing albumen, though traces of yolk substance occurred in the latter near the butt of the inclosed egg. This was due, I believe, to a ruptured and partially escaped yolk. If this explanation is true, is it possible that the yolkless condition of the inclosed egg is also due to the loss of its yolk? It seems well established, however, that albumen can be formed in the oviduct without the presence of a yolk. Possibly foreign bodies when introduced into the oviduct by accident may induce the production of this material. Von Nathusius ('95, p. 655) has pointed out that when a hen lays an egg, the distal portion of the oviduct is so far rolled out that foreign bodies may adhere to it and thus be carried well into its cavity. In this way chicken-yard refuse and feathers, such as have been noted by Landois ('82, p. 23) in eggs, have doubtless reached that position in the oviduct where incorporation in a forming egg was possible. These and like bodies may excite the oviduct to the production of albumen and thus give rise to a core around which a shell might be secreted.

Parasites are also known to make their way into the oviduct, and, though what have been supposed to be tapeworms in eggs

have in all cases thus far carefully inquired into proved to be mere clots of albumen or other like materials (Landois, '94), it is well known that distomes and threadworms do sometimes occur imbedded in egg shells (Landois, '78; Collin, '94). One of these might well form a nucleus around which albumen could be deposited.

But it must also be kept in mind that the ovary and the oviduct are not such independent organs as perhaps has been implied. Davaine ('61, p. 256) states that Claude Bernard opened a hen that had died after laying numerous small yolkless eggs and found the infundibulum closed and the body-cavity full of yolks. It is therefore probable that the simple activity of the ovary may in some indirect way excite the production of albumen in the oviduct, and it is my opinion that many yolkless eggs such as that described in this paper, are formed in this way rather than that they once possessed yolks and through some accident lost them. Such questions, however, are subjects for experimental investigation rather than for speculation.

BIBLIOGRAPHY

BARNES, R.

'63. Description of a Specimen of an Ovum in Ovo. *Trans. Obstetrical Soc. London*, vol. 4, pp. 87–89, pl. 3.

BARNES, R.

'85. Ovum in Ovo: Abnormal Hen's Egg. *British Med. Jour.*, 1885, vol. 2, p. 759.

BARTELS, M.

'95. Hühner Ei mit zwei Dottern. *Sitzungs-Ber. Gesellsch. naturf. Freunde Berlin*, Jahrg. 1895, No. 7, pp. 143–145.

BAUER, R. W.

'98. Ueber das Doppelei eines Haushuhnes. *Biol. Centralbl.*, Bd. 18, No. 8, p. 304.

CHOBAUT, A.

'97. Un œuf de poule monstrueux. *La Feuille d. jeunes Naturalistes*, sér. 3, ann. 27, no. 324, p. 215.

COLLIN, A.
'94. Ein merkwürdiger Einschluss im Hühnerei. *Ornithol. Monatsber.* [Reichenow], Jahrg. 2, No. 1, pp. 3–4.

DAVAINE, C.
'61. Mémoire sur les anomalies de l'œuf. *Compt. Rend. et Mém. Soc. Biol. Paris*, sér. 3, tom. 2, pp. 183–266, pls. 1–2.

DE TONI, E.
'90. Un Uovo di Gallina mostruoso. *Bull. Soc. Veneto-Trentina Sci. Nat.*, tom. 4, no. 4, pp. 236–237.

FÉRÉ, C.
:02. Œuf de poule contenant un autre œuf. *Compt. Rend. et Mém. Soc. Biol. Paris*, tom. 54, pp. 348–349.

FRITSCH, G.
'95. Hühnerei mit einem zweiten im Innern. *Sitzungs-Ber. Gesellsch. naturf. Freunde Berlin*, Jahrg. 1895, No. 10, pp. 202–203.

GRUVEL, A.
:01. Description d'un œuf à double envéloppe. *Proc. Verb. Soc. Sci. Phys. Nat. Bordeaux*, ann. 1900–1901, pp. 20–23.

GRUVEL, A.
:02. Sur un cas spécial d'œuf tératologique. *Proc. Verb. Soc. Sci. Phys. Nat. Bordeaux*, ann. 1901–1902, pp. 72–76.

HERRICK, F. H.
'99a. A Case of Egg within Egg. *Science*, new ser., vol. 9, no. 219, p. 364.

HERRICK, F. H.
'99b. Ovum in Ovo. *Amer. Nat.*, vol. 33, no. 389, pp. 409–414.

IMMERMANN, F.
'99. Ueber Doppeleier beim Huhn. Inaugural-Dissertation, Basel; 8vo, 43 pp., 5 Fig.

KUNSTLER, J., ET BRASCASSAT, M.
:01. Étude sur la collection d'œufs tératologiques du Muséum. *Actes Soc. Linn. Bordeaux*, sér. 6, tom. 6, pp. clxi-clxii.

KUNSTLER, J., ET BRASCASSAT, M.
:02. Étude d'un œuf monstrueux. *La Feuille d. jeunes Naturalistes*, sér. 4, ann. 32, nos. 381–382, p. 200.

LANDOIS, H.
'78. Missbildungen bei Hühner-Eiern. *Zool. Garten*, Jahrg. 19, No. 1, pp. 17–24.

LANDOIS, H.
'82. Fremde Einschlüsse in Hühnereiern. *Humboldt*, Bd. 1, pp. 22–24.

LANDOIS, H.
'92. Ei des rotrückigen Würgers mit drei ineinander geschachtelten Eischalen. 20. *Jahresb. Westfälischen Prov.-Vereins f. Wiss. und Kunst*, 1891, pp. 34–35.

LANDOIS, H.
'94. Würmer in Hühnereiern. 22. *Jahresb. Westfälischen Prov.-Vereins f. Wiss. und Kunst,* 1893–94, pp. 50–51.

LANDOIS, H.
'95. [Notes on Abnormal Hens' Eggs.] 23. *Jahresb. Westfälischen Prov.-Vereins f. Wiss. und Kunst,* 1894–95, pp. 32.

LANDOIS, H.
'99. Hühner-Eier in der freien Bauchhöhle. 27. *Jahresb. Westfälischen Prov.-Vereins f. Wiss. und Kunst,* 1898–99, pp. 52–53.

MAN, J. C. DE.
'78. Mededeeling over eenige Monstra, afkomstig uit de Rotterdamsche Diergaarde. *Tijdschr. Nederl. dierk. Vereen.,* Deel 3, Afl. 4, pp. 153–171.

MÖBIUS, K.
'95. Hühner-Ei mit zwei Dottern. *Sitzungs-Ber. Gesellsch. naturf. Freunde Berlin,* Jahrg. 1895, No. 7, p. 143.

NATHUSIUS, W. v.
'95. Einschluss eines Hühner-Eies, Knorpel-, Knochen-, und Bindegewebe enthaltend. *Arch. f. mikr. Anat.,* Bd. 45, pp. 654–692, Taf. 35.

PANUM, P. L.
'60. Untersuchungen über die Entstehung der Missbildungen zunächst in den Eiern der Vögel. Berlin; 8vo, xii+260 pp., 12 Taf.

PARONA, C., E GRASSI, B.
'77. Sovra alcune Mostruosità di Uova di Gallina. *Atti Soc. Ital. Sci. Nat. Milano,* tom. 20, pp. 103–124, tav. 2.

PHILIPPI, R. A.
'93. Ei im Ei. *Zool. Garten,* Jahrg. 34, No. 2, p. 57.

RABAUD, E.
:02. [Note on Kunstler, J., et Brascassat, M., :02.] *La Feuille d. jeunes Naturalistes,* sér. 4, ann. 32, nos. 381–382, pp. 201–202.

SCHUMACHER, S.
'96. Ein Ei im Ei. *Zool. Anz.,* Bd. 19, No. 510, pp. 366–368.

SUPINO, F.
'97. Deux œufs de poule anomaux. *La Feuille d. jeunes Naturalistes,* sér. 3, ann. 27, no. 323, p. 201.

VAILLANT, L.
'75. [Un œuf de poule monstrueux.] *Compt. Rend. et Mém. Soc. Biol. Paris,* sér. 6, tom. 1, p. 162.